Video Image Recorder
An On Board Recording System for Rail Operations

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Why Image Recording on Rail

Over 50% of crashes at public grade crossings occur where active warning devices exist

More than 250,000 highway-rail grade crossings in the U. S.

Over 425 deaths per year

More than 3,000 highway-rail grade crossing incidents annually

In excess of 300 trespassers on rail property are killed annually

When including metro-lines; a vehicle or pedestrian incident with rail occur every 40 min. in the U. S.

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Images Alone Cannot Tell the Story

- Operational Synchronization
  - Recording system automatically starts recording data when the locomotive begins moving and can be set up to stop when the locomotive completely stops
  - Data including speed, direction, PC switch, horn and Tach all link to voice and image data in a digital format
- Video
  - Locomotive-mounted digital video camera views right-of-way in direction of travel
    - Video captured continuously
- Audio
  - Multiple microphones can be used to record voices as well as environmental sounds such as locomotive horn or signals

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Development History

In Partnership with the Industry

Research and Development program began 1984

Challenges for development team

- Using components that could operate reliably on a locomotive
- Video camera image quality
- Storage of data in a non-volatile format

Recording usable audio information

Process, Process, Process ….

Setting standard of what to do with the information and how it could be used is as important as the technical challenges

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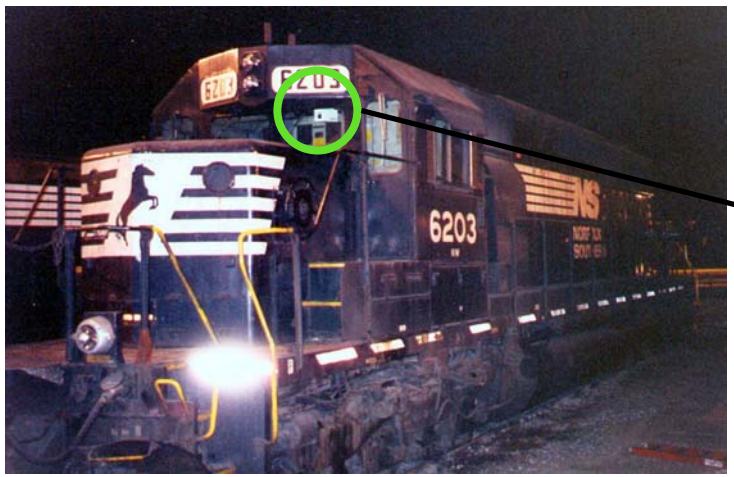
Development History

In Partnership with the Industry

First full-up and successful deployment test on a locomotive Jan.- Jun. 1997

- Used "Off-the-Shelf" PC components in a 24" x 24" x 12" enclosure
- Camera was a standard security camera
- Data recording device was a modified PC hard drive



Control Unit

(looked compact on the bench!)

Standard security camera

(large, expensive & awkward to install)

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Development History
In Partnership with the Industry

Product development Oct. '97- June 1998

Product in-service operational testing April-Nov. 1998

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Resulting Product Introduced 1998

RailView a digital video and event recorder that mounts to locomotives and captures, digitizes and stores the sequence of events leading up to and after an incident.

Built for the Railroad Industry

- Simple to install and test
  - LEDs provide a simple status indication of the system
  - Video/Audio output allows easy full system test
- Tamper Resistant
  - Tamper resistant camera mounting
  - High security lock on recorder enclosure
  - Loss of audio or video is detected and logged
  - Loss of power is logged with type of loss

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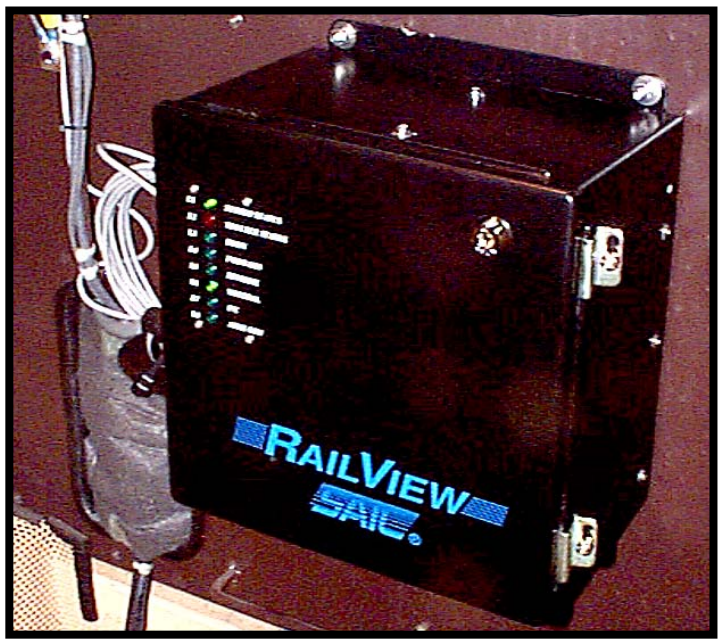
System Components

Major components:

- Rugged video camera with built-in microphone
- Camera mounting bracket
- Recorder Unit with removable memory module



Other System Links:

- Multiple external microphones
- Locomotive interface cable
- Data Download
- Playback & Utility software

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System Components

Recorder Unit

- Compact 10” x 10” x 6” enclosure
- All interface/test connectors on left side
- LED panel on front door
- All locomotive inputs on one connector
- Connector for video camera

Compact Enclosure:

- Simple Installation

Interface Connections:

- Serial Port DB9F
- Parallel Port DB25F
- Video Out & In (BNC)
- Audio Out & In
- Video Camera DB15F
- Locomotive Interface Connector

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System Components

Video Camera

- Small 2.5” x 2.75” x 4.5”, 42 oz. design
- Extremely rugged, sealed, tamperproof, all-weather die-cast zinc enclosure
- Built-in, sealed microphone
- Lexan lens cover with built-in filtering
- Electronic exposure control optimized for application

Installed Camera

Video Camera

System Control Unit

Video/Audio Recording Memory

- Hard Drive provides more than 5 days of long-term recording
- 128 MB removable PC Card provides approx. 40-60 min. of short-term recording
- Actual record time can vary due to compressibility of image
- Redundant memory architecture using different technologies ensures that an incident record is captured

PC Card
Memory Module

RailView - Today and Tomorrow

The technical challenges of providing video, audio and event recording from a locomotive have been addressed

Process and procedure issues are the real challenge going forward